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CIT 591 Introduction to Software Development

Module 5: Data Collections – Arrays and ArrayLists

Module Learning Objectives

- Represent 2 dimensional data
- Work with data where the amount of data is not pre-specified
- Distinguish between when to use an array and when to use an arraylist

Module Glossary

- **Array:** A data structure consisting of a collection of elements that allows for easy access of any element.
- **ArrayList:** An arraylist in Java is a dynamic array that can grow as needed.
- **CTRL + space (key combo):** The CTRL + space keyboard shortcut allows for autocompletion in many situations. For example, type *sysout* and then do CTRL + space to get `System.out.println`.
- **Zero indexing:** Indexing into a collection of data is the methodology by which the nth element of the collection can be directly retrieved. Zero indexing means that the very first piece of data in the collection can be retrieved using the index 0, the next piece with index 1, and so on.

Module Resources

- **Textbook Readings:**
  - 7.1: Arrays
  - 7.2: The Enhanced for Loop
  - 7.6: Two-Dimensional Arrays
  - 7.7 Array Lists
  - Good Supplemental Info
    - 7.3: Common Array Algorithms (Reminder: try these algorithms yourself!)
    - 7.4: Problem Solving: Adapting Algorithms
- **Websites:**
  - ArrayLists (Java Documentation)

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Key Concepts & Examples

Arrays: An array is a data structure consisting of a collection of elements. An array is stored such that any element can be easily accessed via the `[ ]` syntax, meaning that you don't have to create separate variables for each individual element. **Remember that arrays are 0 indexed**, meaning that `arr[3]` will actually correspond to the 4th element in the array. Arrays are static – they cannot change size.

Use loops to find information in an array, such as what value is at a particular position in the collection.

- Examples used in the video: people standing in a line; seats in a classroom; cars in a parking garage – the 101st car cannot park in a full garage that only has 100 spots.

ArrayLists: Unlike arrays which can only contain a fixed amount of data, an ArrayList in Java is a **dynamic** array that can grow as needed. This is helpful for storing items in a collection that may change size.

- Examples used in the video: names of friends; lists of songs

2D Arrays: Arrays aren't limited to one dimension. By creating an array of arrays, we can capture two-dimensional data. When creating a grid such as a chessboard, remember that the syntax is `[rowIndex][columnIndex]`and **don't forget to account for zero indexing** (so for example, `ChessPieces[4][5]` would be the fifth row and the sixth column).

If you are interested in pursuing **machine learning**, you will see a lot more of these! In math, this type of 2 dimensional structure is also called a matrix. Matrices are fundamental to the subject of linear algebra which in turn is a fundamental tool for machine learning.

- Example used in the video: modeling a chessboard including the position and color of all pieces